

Application No. 09/681,611
Attorney Docket No. 15-XZ-5728
Amendment dated August 11, 2004
Reply to Office Action of May 19, 2004

REMARKS AND ARGUMENTS

In the March 24, 2004 Office Action, FIG. 1 was objected to. Claims 1, 6, 7, 13, 18-20 and 26-29 were rejected. Claims 21-25 were allowed. Claims 2-5, 8-12 and 14-17 were objected to as being dependent upon a rejected base claim, but otherwise allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 2-5, 8-12 and 14-17 have been correspondingly amended.

Claim 1 has been amended in response to the Examiner's rejections. Claims 1, 21, and 26 have been amended to correct antecedent basis. However, the amendment to claim 21 should not affect the Examiner's allowance of claim 21 and corresponding dependent claims 22-25. Claims 2-5, 8-12 and 14-17 have been amended in response to the Examiner's objection and should therefore be in condition for allowance. Claims 2 and 10 have also been amended to correct antecedent basis as necessitated by the amendment of the objected claims 2-5, 8-12 and 14-17.

Claim 1 has been amended to recite computing a characteristic mask using the low energy level image and by comparing one or more pixels of a gradient mask to one or more corresponding pixels of a localization mask.

Claims 1, 6, 13, 18-20, and 26-28 were rejected under 35 U.S.C. § 102(b) as being anticipated by Shimura, U.S. Patent No. 5,301,107.

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Claims 7 and 29 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shimura in view of Sones et al., U.S. Patent No. 4,792,900.

Rejections under 35 U.S.C. § 102(b)

The Applicant first turns to the rejection of claims 1, 6, 13, 18-20, and 26-28 under 35 U.S.C. § 102(b) as being anticipated by Shimura. Shimura describes a method for forming energy subtraction images. Specifically, Shimura discloses obtaining a bone image signal S1 and a soft tissue image signal S2. (col. 15, lines 26-56). The bone image signal S1 is obtained by subtracting a fraction of a high-energy x-ray image SO2 from a low-energy x-ray image SO1. (col. 15, lines 26-40; Equation (1)). The soft tissue image is obtained by subtracting the low-energy image SO1 from the high-energy image SO2. (col. 15, lines 46-56; Equation (2)).

However, Shimura does not teach computing a characteristic mask using the low energy level image and by comparing one or more pixels of a gradient mask to one or more corresponding pixels of a localization mask, as recited in amended claim 1. As described above, Shimura merely discloses the subtraction of one image from another in order to obtain a third image (for example, either a bone or soft-tissue image). (col. 15, lines 26-56; Equations (1) and (2)). Shimura does not teach the comparison of any mask or image to any other mask or image. Therefore, the Applicant respectfully submits that Shimura is incapable of teaching elements of at least claim 1.

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Shimura also discloses the removal of noise components from a bone image. (col. 19, lines 10-15). Specifically, Shimura describes the subtraction of image signal components of a smoothed image signal $\bar{S}1$ from the bone image signal $S1$. (col. 19, lines 10-20). The result of this subtraction is a noise signal SN representative of a noise image 48. (col. 19, lines 15-24). The noise image 48 only contains noise. (col. 19, lines 21-23). The noise signal SN and the soft tissue image signal $S2$ are then weighted and added to each other. (col. 19, lines 44-50). The result of this addition is a processed soft tissue image 46 that includes approximately the same image information as the soft tissue image 47 but includes less noise components. (col. 19, lines 44-55).

However, Shimura does not teach automatically computing a cancellation parameter having a maximum likelihood of canceling one of the first and second types of structure from a structure cancelled image, as recited in claim 26. As described above, Shimura merely describes the subtraction of a smoothed image signal from a bone image signal (resulting in the noise signal), followed by the weighting and addition of the noise signal to the soft tissue image signal. (col. 19, lines 10-67). Shimura does not disclose any computation of any parameter having a maximum likelihood of canceling out any type of structure from any image. Conversely, Shimura is limited to the computation of a singular noise signal from one image and the addition of the same noise signal to another image. (col. 19, lines 10-67). Consequently, the Applicant respectfully submits that Shimura is incapable of teaching elements of at least claim 26.

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The present rejection encompasses claims 1, 6, 13, 18-20, and 26-28. Claim 1 has been amended to recite limitations not taught by Shimura. Claims 6, 13, 18-20, and 27-28 depend from claims 1 and 26. Therefore, the Applicant respectfully submits that claims 1, 6, 13, 18-20, and 26-28 should be allowable.

Rejections under 35 U.S.C. § 103(a)

The Applicant next turns to the rejection of claims 7 and 29 under 35 U.S.C. § 103(a) as being unpatentable over Shimura in view of Sones. The Applicant agrees with the Examiner's statement: "Shimura does not expressly disclose utilizing a pre-computed look-up table of cancellation parameters for anatomies at various high and low energy pairs." (May 19, 2004 Office Action, page 6). The Applicant further respectfully submits that Shimura does not teach or suggest the utilization of any look-up table of any parameters for any energy pair and therefore is incapable of teaching or suggesting elements of at least claims 7 and 29.

However, Sones does not overcome the shortcomings of Shimura. Sones describes an adaptive filter for dual energy radiographic imaging. Sones discloses two tables of coefficients used in an equation to alter the value of a given pixel (i, j). (col. 8, lines 4-26; col. 9, lines 32-37). By applying coefficients in the tables to pixel values, Sones filters signal noise in pixels with a greater potential for signal noise. (col. 7, line 62 - col. 8, line 3; Equation (6)). Specifically, the coefficients in the tables are used to

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“replace[a] given pixel value with the sum of A times the given pixel value plus B times each of the eight immediately adjacent pixel values . . .” (col. 8, lines 14-16).

The values of A and B are determined from the tables of Sones by utilizing the “pixel value $U(i, j)$ to look up the corresponding A value and a second look-up table 86 which is addressed by the pixel value to look up the corresponding B value.” (col. 9, lines 32-36). Therefore, an unfiltered pixel value is used to look up the values of both A and B in the look-up tables of Sones.

However, Sones does not teach or suggest a first or second cancellation parameter selected from a predetermined range in a look-up table, where the range is determined by an effective kVp used to acquire the high level image and an effective kVp used to acquire the low level image, as recited in claim 7. In addition, Sones does not teach or suggest utilizing a pre-computed look-up table of cancellation parameters for anatomies at various high and low energy pairs, as recited in claim 29. The tables of Sones are utilized by using a single value, namely the pixel value, to look up values of the two coefficients. (col. 9, lines 32-37). In this way, Sones only requires one known value, the pixel value, to determine the coefficients A and B. Sones does not use a pair of effective kVp for high and low level images to look up a cancellation parameter selected from a predetermined range. In addition, the tables of Sones do not list any parameters at various high and low energy pairs.

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Moreover, the tables of Sones merely list coefficients to average a pixel value, and do not list cancellation parameters. However, both claim 7 and 29 recite a look-up table containing cancellation parameters.

Thus, the Applicant respectfully submits that Sones does not teach or suggest elements of at least claims 7 and 29.

Furthermore, a combination of Shimura and Sones also does not teach or suggest elements of at least claims 7 and 29. As described above, neither Shimura nor Sones, alone or in combination, teach or suggest a first or second cancellation parameter selected from a predetermined range in a look-up table, where the range is determined by an effective kVp used to acquire the high level image and an effective kVp used to acquire the low level image, as recited in claim 7. In addition, a combination of Shimura and Sones, alone or in combination, also does not teach or suggest utilizing a pre-computed look-up table of cancellation parameters for anatomies at various high and low energy pairs, as recited in claim 29.

Therefore, the Applicant respectfully submits a combination of Shimura and Sones also fails teach or suggest elements of at least claims 7 and 29.

The present rejection encompasses claims 7 and 29. The Applicant respectfully submits that neither Shimura nor Sones, alone or in combination, teach or suggest elements of claims 7 and 29. Therefore, claims 7 and 29 should be allowable.

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The Applicant respectfully submits that the claims of the present application should be allowable.

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CONCLUSION

If the Examiner has any questions or the Applicant can be of any assistance, the Examiner is invited and encouraged to contact the Applicant at the number below.

The Commissioner is authorized to charge any necessary fees or credit any overpayment to the Deposit Account of GTC, Account No. 07-0845.

Respectfully submitted,

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